VESTIBULAR TRAINING OF COSMONAUTS

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The vestibular training of cosmonauts involves active /1* stimuli, designed to stimulate both sections of the labyrinth and the functional system of the analyzers perceiving space and performing the function of maintaining the equillibrium of the human body. They include: linear and angular accelerations, Coriolis forces, actions on the afferent systems controlling the spatial position of the human body. The selection of methodological approaches is broad and they have been described in some detail in the literature [Voyachek, V. I., 1946; Khilov, K. L., 1933, 1934; Bryanov, I. I., 1963; Markaryan, S. S., 1965; Yemel'yanov, M. D., Yuganov, Ye. M., 1962, 1963].

The plans developed for the vestitular training of pilots [Kulikovskiy, G. G., 1939] are used as the basis for the training of cosmonauts.

The following basic principles of training are followed:

-- in all vestibular training sessions, use actions characteristic for the conditions of space flight;

-- perform vestibular training by acting on both sections of the labyrinth;

-- in order to maintain a sufficient level of vestibular stability, it is maintained by active methods throughout the year;

-- vestibular training sessions are performed by the mixed method, i.e., by alternation of passive and active training sessions (in the system of physical training);

-- during vestibular training, the individual physiological /2

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*Numbers in the margin indicate pagination in the foreign text.

peculiarities of the organism of each cosmonaut are considered, as well as his vestibular stability;

-- in order to achieve good results of increased vestibular stability of cosmonauts, training sessions are performed systematically, but the effects should not accumulate.

Before training, the initial level of vestibular stability to the following adequate vestibular stimuli is determined:

-- to linear accelerations -- by rocking on Khilov swings [Khilov, K. L., 1933, 1934];

-- to the cumulative effects of Coriolis accelerations -- by rotation of the subject on a couch in the horizontal plane and active tilting of the head and body in the sagital or frontal planes [Bryanov, I. I., 1963; Markaryan, S. S., 1965];

-- to the effects of angular acceleration -- by rotation of the subject on a couch in the horizontal plane with an angular acceleration of 180°/sec and alternating stimulation of all semicircular channels by their placement in the plane of rotation of the couch with subsequent movement of the couch on an unstable support [Yemel'yanov, M. D., Yuganov, Ye. M., 1962];

-- to actions on the afferent system controlling the spatial position of the body -- optokinetic stimulus under conditions of free balancing on an unstable support [Yemel'yanov, M. D., Yuganov, Ye. M., 1963].

Based on an evaluation of the resistance to each type of action, an approximate individual training program is designed, involving two training sessions per weak with gradually increasing intensity of stimulus. The number of sessions given each cosmonaut varies depending on his initial level of vestibular stability. /3

Passive training sessions involving rotating couches, swings, etc. are performed along with active vestibular sessions (special gymnastics; rotation on a loping device, Rhine wheels; acrobatic exercises on a trampoline, swimming, sporting games. [Arkhangel'skiy, A. D., 1934; Lozanov, N. N., 1938; Yarotskiy,

A. I., 1954; Plaksenko, L. S., 1959; Brykov, K. I., 1965; Korobkov, A. V., 1966; Lopukhin, V. Ya., 1970].

As an example of the individual approach to training sessions, we might note the training of the commander of the Soyuz 12 spacecraft, V. G. Lazarev. During the evaluation of the initial level of his vestibular stability, he tolerated linear accelerations for 15 minutes without VR; cumulative effect of Coriolis accelerations also 15 minutes without VR; efects on the afferent system controlling the spatial position of the human body, 6 minutes, with some oscillation on the unstable support during the optokinetic action; effects of angular accelerations with transition to unstable support tolerated without VR or disruption of equillibrium. Significant fluctuations (up to 25% of the initial level) were noted in certain physiological indicators during rocking, exposure to Coriolis forces and the optokinetic effect. Therefore, primary attention during training was given to these types of action. /4

The training plan was as follows:

Type of Action	Weeks														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Linear Accelerations	10	12	15		15			15		15		15	15	15	
Coriolis Accelerations		5		7	10	15	15		15		15		15	15	15
Optokinetic and Balancing	6			6		6	7		6		6	6	6		6
Angular Acceleration			6					6		6					

Note: The numbers in the table represent the duration of the effect during the training sessions.

After the training cycle before his flight, V. G. Lazarev withstood all types of effects well, the fluctuations in the physiological indicators being adequate to the loads applied.

(Signature)
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